ideal of the corn-breeder should then be continuous hybridization between biotypes, rather than the isolation of pure strains.—R. R. GATES.

Isolation and mutation.—While the final adjudication of the claims of the various theories of evolution must be made on an experimental basis, such data must be in harmony with the facts of plant and animal distribution, as is pointed out in a suggestive paper by LEAVITT.[24] It is of much interest to observe that zoologists, as a rule, have been less inclined to believe in mutation than have botanists. This is in part due, LEAVITT thinks, to a less perfect grasp of the theory by some of the zoologists, but in part due also to the fact that most students of animal distribution believe that isolation of closely related species is a most important principle in evolution. The author shows that there are innumerable cases of overlap in closely related plants of all groups, most notable, perhaps, in the widely varying thallophytes and bryophytes, but abundant in the seed plants. There is plenty of evidence that new species may have originated from the old without geographic isolation, although cases suggesting the latter are not wanting. Therefore, it is concluded, many facts of plant distribution favor the mutation theory, though they do not show that this is the only valid theory of evolution.—H. C. COWLES.

Osmotic properties of root hairs.—HILL[25] has investigated the osmotic properties of the root hairs of *Glyceria maritima*, *Suaeda maritima*, and *Salicornia herbacea*, which grow in a salt marsh subject to great changes in the osmotic pressure of its soil water, due to periodic flooding by the tides and to occasional drenching rains. He finds that the hairs show marked and rather rapid variation in osmotic pressure corresponding in variation to the osmotic pressure of the soil water. This variation is not due to the entrance of the abundant chlorids of the soil water, for in no case could he find chlorids in the root hairs, although they could be found in traces in the upper portions of the seedlings. The high osmotic pressure of the soil water seems to act through the irritability of the protoplasm, causing a dissociation of the compounds of the cells. He thinks OSTERHOUT is wrong in concluding that osmosis is not an important process in plant nutrition, and points out the fact that all the data of this investigator can be explained by the fact that plants can modify their osmotic properties readily in response to and in protection against rapidly varying external osmotic pressures.—WILLIAM CROCKER.

Statolith theory.—BUDER[26] comes to the support of the statolith theory with a set of well-chosen and critical experiments that seem to justify his conclusions,

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[24] LEAVITT, R. S., The geographic distribution of nearly related species. Amer. Nat. **41**:207–240. 1907.

[25] HILL, F. G., Observations on the osmotic properties of the root hairs of certain salt marsh plants. New Phytologist **7**:133–142. 1908.

[26] BUDER, JOHANNES, Untersuchungen zur Statolithenhypothese. Festschrift zur Feier des 25-jährigen Bestehens der Deutsch. Bot. Gesells. Ber. **26**:162–193. 1908.

which are briefly as follows: Contrary to FITTING'S conclusion, in a combination of the rest position with various angles, the statolith starch takes the position that would be expected by the statolith theory. Centrifugal acceleration causes the movement of the starch that the hypothesis assumes, as shown by accelerations from 0.13 *g* to 9 *g*. In these various accelerations the time of the movement of the starch to the side of the cells coincides with the presentation time as determined by BACH. In the intermittent exposures of opposite sides when these exposures are of short duration the starch moves to the side of the cell of the most effective exposure only after the process is long continued, corresponding to the slow reaction in these cases. However well this paper may answer a number of the arguments against the statolith theory, there are yet a number unanswered and this whole matter of geotropic reaction seems too complex to be entirely explained in such a simple way.—WM. CROCKER.

Ray-tracheids in Cunninghamia.—The complex structure of the medullary rays of living Abietineae, consisting of parenchyma cells, ray-tracheids, and an elaborate system of ligneous resin-canals, has been used as one of the evidences of a highly specialized and relatively modern group. JEFFREY[27] has studied the marginal ray-tracheids that occur occasionally in Cunninghamia and has found them to be due to wounding, being most numerous in the region of the injured annual rings opposits the wound-callus. They resemble in general those described for certain genera of the Taxodineae and Cupressineae, and JEFFREY thinks that this is additional evidence that these two tribes have been derived from the Abietineae, the ray-tracheids being "vestigial or reversionary." He emphasizes this view by calling attention to the fact that there is no evidence that the Taxodineae and Cupressineae existed before the end of the Cretaceous. Such conclusions illustrate the fact that apparent simplicity of structure may not indicate greater antiquity than greater complexity of structure.—J. M. C.

Vascular system of Ranales.—WORSDELL[28] maintains that the primitive angiosperms had large leaves, and that as a result the vascular bundles were disposed in a scattered manner, as is seen in the monocotyledons. He considers that there is in all cases a single terminal cotyledon in the embryo, but that it may split and the halves diverge through 180°. Like the cotyledon, all the leaves are terminal organs, and hence dominate the stem ("grandifoliate"). From this condition has been derived the one in which the stem is dominant and the leaves small ("parvifoliate"). This view of phylogeny naturally leads WORSDELL to reject the evidence derived from the vascular system of seedlings adduced by JEFFREY and others, although he claims to adopt the "recapitulation theory." In the present paper he outlines the results of an extensive study of the leaves in

[27] JEFFREY, EDWARD C., Traumatic ray-tracheids in *Cunninghamia sinensis*. Annals of Botany **22**:593–602. *pl. 31*. 1908.

[28] WORSDELL, W. C., A study of the vascular system in certain orders of the Ranales. Annals of Botany **22**:651–682. *pls. 32, 33*. 1908.